CLAIMS

1.   A transmission capacity allocation method for configuring a path with guaranteed transmission capacity between a call request terminal and a call requested terminal via one

5   or more switching hubs learning respective MAC (Media Access Control) addresses of terminals in communication with each other and configuring a single path between learned terminals, wherein:

network resource management means managing connections between the terminals and the switching hubs, as well as between the switching hubs, and transmission capacity

10   of transmission links associated with the connections, is provided on a network;

the call request terminal transmits a call request containing information on the transmission capacity whose allocation is requested in order to perform communication, along with its own terminal address and the address of the call requested terminal;

the network resource management means, in response to the call request from the

15   call request terminal, makes an assessment as to whether transmission capacity to be used can be assured along the path traversing switching hubs between the call request terminal and the call requested terminal and transmits the call request to the call requested terminal if it can be assured, or transmits an incoming call rejection to the call request terminal if it cannot be assured;

20   the call requested terminal transmits a receive acknowledgement to the call request terminal through the network resource management means if it is itself communication-enabled, and transmits a call rejection if it is itself communication-disabled;

the network resource management means, along with forwarding a receive acknowledgement or a call rejection from the call requested terminal to the corresponding

25   call request terminal, releases transmission capacity assured for the call request associated with the call rejection when the call rejection is received from the call requested terminal;

the call request terminal, upon receipt of the receive nowledgement from the call requested terminal, recognizes that communication with guaranteed transmission capacity has been established and initiates transmission of data frames to the call requested

terminal;

the call request terminal or the call requested terminal, upon completion of communication, transmits a clear request to a peer terminal via the network resource management means; and,

5   upon receipt of the clear request, the network resource management means releases transmission capacity in case transmission capacity corresponding to the clear request has been assured.

2.   The transmission capacity allocation method according to claim 1, wherein:

10   during communication with the call requested terminal, if necessary, the call request terminal requests changes in the transmission capacity of the communication path, and,

in response to this request, the network resource management means changes the transmission capacity of the communication path to the extent that the maximum assurable capacity is not exceeded.

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3.   The transmission capacity allocation method according to claim 1, wherein:
along with the receive acknowledgement, the call requested terminal requests allocation of transmission capacity in the direction of the call request terminal from the call requested terminal, and

20   in response to this request, the network resource management means makes an assessment as to whether the transmission capacity can be assured and notifies said call requested terminal of the results.

4.   The transmission capacity allocation method according to claim 1, wherein:

25   the call request terminal is a terminal carrying out stream data delivery service,

the call requested terminal, prior to receiving the stream data delivery service, issues a notification of completion of preparations for receiving the delivery service using a broadcast frame or a frame destined for the call request terminal, and,

in response to the notification, the switching hubs along the path between the call

request terminal and the call requested terminal finish learning the MAC address of the call requested terminal.

5.   The transmission capacity allocation method according to claim 1, wherein:

while communication is in progress, at intervals within the aging time of the MAC address learning function of the switching hubs on the network, the call requested terminal transmits the data of at least one frame to the call request terminal, and

the switching hubs along the path between the call request terminal and the call requested terminal continue learning the MAC address of the above-mentioned call requested terminal using the data of at least one frame.

6.   The transmission capacity allocation method according to claim 1, wherein:

the network resource management means manages the usage status of VLAN (Virtual Local Area Network) identifiers represented by TCI (Tag Control Information), and, when a receive acknowledgement is forwarded from the call requested terminal to the call request terminal, along with attaching a VLAN tag containing TCI corresponding to an unused VLAN identifier to the receive acknowledgement, stores the VLAN identifier as being in use;

the call request terminal reads the VLAN identifier from the VLAN tag attached to the receive acknowledgement obtained from the network resource management means and, when transmitting a frame to the call requested terminal, attaches a VLAN tag thereto that corresponds to the VLAN identifier that has been read;

if a VLAN tag is attached to the received frame, the switching hubs learn the source MAC address and the VLAN identifier as a pair when carrying out MAC address learning for the frame and set the VLAN identifier with a time-out period in the input ports that received the received frame and the output ports selected during forwarding;

the call request terminal, in order to maintain the VLAN set up by the switching hubs, transmits one or more frames, to which VLAN tags corresponding to the VLAN are attached, within the time-out period;

upon receipt of a frame with a VLAN tag attached thereto from the call request terminal, the call requested terminal reads the VLAN identifier from the VLAN tag, and, when a frame is transmitted to the call request terminal, a VLAN tag corresponding to the VLAN identifier that has been read is attached thereto;

5 when the call request terminal or the call requested terminal cuts off communication with a peer terminal, it transmits a clear request to the network resource management means by attaching thereto a VLAN tag corresponding to the VLAN identifier that has been used for communication and stops attaching VLAN tags to frames upon transmission of the clear request; and,

10 upon receipt of the clear request with a VLAN tag attached thereto, the network resource management means stores the VLAN identifier as being unused.

7. The transmission capacity allocation method according to claim 1, wherein transmission capacity is allocated in advance even to currently unused communication 15 paths that may be switched to in the future based on the spanning tree protocol, in accordance with which networks are rebuilt so as not to form loops logically even if the physical network does form a loop.

8. The transmission capacity allocation method according to claim 7, wherein, when 20 the currently used communication path overlaps with a currently unused communication path that may be switched to in the future, allocation of transmission capacity to said currently unused communication path is prohibited.

9. The transmission capacity allocation method according to claim 1, wherein, when 25 the call request terminal issues a request for multicast communication, transmission capacity is assured along the transmission links of each path used for the requested multicast communication.

10. The transmission capacity allocation method according to claim 1, wherein the

network resource management means uses IGMP (Internet Group Management Protocol), GMRP (GARP Multicast Registration Protocol), or GVRP (GARP VLAN Registration Protocol) to perform address management during multicast delivery of stream data.

5   11.   The transmission capacity allocation method according to claim 1, wherein, in order to transmit information regarding correspondents, transmission capacity, assurability of capacity, acceptance/rejection of incoming calls, and release of capacity, the network resource management means and the terminals use SIP (Session Initiation Protocol).

10   12.   The transmission capacity allocation method according to claim 1, wherein connection of the switching hubs and detection of the transmission capacity, configuration of the switching hubs via access by the network resource management means, as well as notification of the network resource management means by the switching hubs, are performed by the network resource management means and the switching hubs based on

15   SNMP (Simple Network Management Protocol), RMON (Remote Network Monitoring), or RMON2 (Remote Network Monitoring MIB Version2).

13.   The transmission capacity allocation method according to claim 1, wherein:

the co-existence of frames with guaranteed maximum transmission capacity and

20   non-guaranteed Best Effort type frames is permitted,

with the call request terminal transmitting frames with guaranteed maximum transmission capacity by appending priority markings thereto,

such that the call request terminal, the network resource management means, and the call requested terminal can process transmission capacity allocation only for frames, to

25   which the priority markings are appended.

14.   A communications network comprising a plurality of terminals, one or more switching hubs that learn respective MAC (Media Access Control) addresses of the terminals in communication with each other and configure a single path between learned

terminals, and network resource management means configuring a path traversing any one or more of the one or more switching hubs between the call request terminal and the call requested terminal amongst the plurality of terminals, wherein:

each one of the plurality of terminals comprises: means for transmitting a call

5   request containing information on the transmission capacity whose allocation is requested in order to perform communication, along with its own terminal address and the address of the call requested terminal, when the terminal itself operates as a call request terminal; means for transmitting a receive acknowledgement when it is itself communication-enabled, and a call rejection when it is itself communication-disabled, to the call request

10   terminal associated with a call request via the network resource management means when a call request is received and the terminal itself operates as a call requested terminal; means for recognizing that communication with guaranteed transmission capacity has been established and initiating transmission of data frames to the call requested terminal upon receipt of a receive acknowledgement from the call requested terminal when operating as a

15   call request terminal; and means for transmitting a clear request to a peer terminal via the network resource management means upon completion of communication; and

the network resource management means comprises: means for storing the connection between the terminals and the switching hubs, as well as between the switching hubs, and the transmission capacity of the transmission links associated with this

20   connection; means for consulting the storage means in response to a call request from a call request terminal and making an assessment as to whether the transmission capacity to be used can be assured along a path traversing switching hubs between a call request terminal and a call requested terminal; means for increasing the transmission capacity to be used in the storage means by an amount corresponding to said assurance and transmitting a

25   call request from said call request terminal to said call requested terminal if, in accordance with the assessment results of the assessment means, it can be assured, or transmitting an incoming call rejection to said call request terminal if it cannot be assured; means for forwarding a receive acknowledgement or a call rejection from the call requested terminal to the corresponding call request terminal; means for releasing transmission capacity

assured for the call request associated with the call rejection and withdrawing it from the storage means when a call rejection is received from the call requested terminal; and means for releasing transmission capacity and withdrawing it from the storage means when a clear request is received from the other terminal participating in communication in case

5   transmission capacity corresponding to the clear request has been assured.

15.   The communications network according to claim 14, wherein the network resource management means is provided in any one of the one or more switching hubs.

10   16.   The communications network according to claim 14, wherein one or more switching hubs are connected to the tree structure, with the network resource management means located in the vicinity of the root (root) of the tree structure.

17.   The communications network according to claim 14, wherein:

15   the plurality of terminals are terminals compliant with frames having guaranteed maximum transmission capacity and,

on the network, Best-Effort type terminals compliant only with frames having no guaranteed maximum transmission capacity may co-exist therewith and

the terminals compliant with frames having guaranteed maximum transmission

20   capacity can have means for appending priority markings to frames with guaranteed transmission capacity.

18.   The communications network according to claim 17, wherein:

each of the switching hubs comprises means for sending input frames, if the input

25   frames have priority markings, to transmission links in preference to input frames without priority markings.

19.   The communications network according to claim 18, wherein:

each of the switching hubs comprises means which, whenever input frames have

priority markings and the destination MAC addresses have been learned, sends said input frames to transmission links in preference to input frames without priority markings.

20. The communications network according to claim 18, wherein each of the switching hubs comprises means for processing the MAC address learning of priority-marked frames in preference to frames without priority markings.

21. The communications network according to claim 17, wherein the three bits of TCI that represent priority are used for priority indication.

22. The communications network according to claim 21, wherein means for attaching or removing TCI from non-TCI-compliant frames is provided in switching hubs at the edge of the network.

23. The communications network according to claim 18, wherein each one of the switching hubs comprises means for sending a PAUSE frame that halts transmission to the corresponding input transmission links when the buffer size of frames not subject to priority processing becomes equal to or more than a predetermined value Thmax and sending a PAUSE frame that disables the suspension of transmission to the corresponding transmission links when a predetermined value Thmin (Thmax > Thmin) is reached.

24. The communications network according to claim 18, wherein each one of the switching hubs comprises means for configuring the threshold value of the input frame rate of ports connected to the terminals manually or via access by the network resource management means, as well as means for handling frames with priority markings and frame rates exceeding the threshold value as non-priority frames.

25. The communications network according to claim 18, wherein, amongst the switching hubs, hubs at the edge of the network comprise means which, upon receipt of a

notification of source MAC addresses and destination MAC addresses for which the maximum transmission capacity is guaranteed from the network resource management means, activates the priority processing markings of frames with these MAC addresses, and, upon receipt of a notification of MAC addresses without guaranteed maximum

5 transmission capacity from the network resource management means, removes the priority processing markings of the frames with these MAC addresses.

26. A network resource management device for configuring a path traversing one or more transmission links and one or more switching hubs between terminals on a network,

10 wherein the terminals are terminals comprising means for reserving transmission capacity to be used upon a call request,

the switching hubs are switching hubs with an MAC address learning function that learn the respective MAC (Media Access Control) addresses of terminals in communication with each other and configure a single path between the learned terminals,

15 with the network resource management device comprising:

means for storing connections between the terminals and the switching hubs, as well as between the switching hubs, and the transmission capacity of the transmission links associated with the connections;

means for consulting the storage means in response to the call request from the call

20 request terminal and making an assessment as to whether the transmission capacity to be used can be assured along the path traversing switching hubs between the call request terminal and the call requested terminal;

means for increasing the transmission capacity to be used in the storage means by an amount corresponding to said assurance and transmitting a call request from said call

25 request terminal to said call requested terminal if, in accordance with the assessment results of the assessment means, it can be assured, or transmitting an incoming call rejection to said call request terminal if it cannot be assured;

means for forwarding a receive acknowledgement or a call rejection from the call requested terminal to the corresponding call request terminal and means for releasing

transmission capacity assured for the call request associated with the call rejection and withdrawing it from the storage means when a call rejection is received from the call requested terminal;

5 and means for releasing transmission capacity and withdrawing it from the storage means when a clear request is received from the other terminal participating in communication in case transmission capacity corresponding to the clear request has been assured.

27. The network resource management device according to claim 26, comprising means 10 for managing the usage status of VLAN identifiers represented by TCI, wherein:

the managing means includes:

means for attaching a VLAN tag containing TCI corresponding to an unused VLAN identifier to a receive acknowledgement when a receive acknowledgement is forwarded from the call requested terminal to the call request terminal;

15 means for storing the VLAN identifier corresponding to the attached VLAN tag as being in use; and

means which, upon receipt of a clear request with the VLAN tag attached thereto, stores the VLAN identifier as being unused.